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Introduction

This course provides an overview of the petroleum technology industry. This course is aligned with the textbook: "Fundamentals of Petroleum" by the University of Texas at Austin.

Introduction

This course provides an overview of petroleum technology, including petroleum origins, geology, mapping techniques, exploration, and drilling.

Textbook used for this course: "Fundamentals of Petroleum", 5th Edition, by the University of Texas at Austin

Course Author:

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Industrial Technology

Aims Community College

1. Common Rocks and Minerals

This course provides an overview of the petroleum technology industry. This course is aligned with the textbook: "Fundamentals of Petroleum" by Kate VanDyke. Course author: Lee McMains lee.mcmains@aims.edu

Common Rocks and Minerals Associated with Petroleum

In this module we will consider the different types of rock, how they're formed, and discover their roles in the production of petroleum

Objectives and Big Questions

At the completion of this module you will be able to:

- Identify three basic rock types.
- Explain their roles in the production and accumulation of petroleum.

As you work through this module, keep the following questions in mind:

- What are the different types of rock?
- Why are some rocks different from others?
- What does the Earth look like, under my feet?
- What field of science concerns itself with these studies?



Reading:

Read "Basic Concepts of Geology" and "Categorizing Rocks" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Lectures:

[Lecture 1: The Earth Beneath Our Feet.](#)



Notes for Lecture 1

Lecture 2: Not All Rocks Are the Same.



Notes for Lecture 2



Links:

Please visit and study the following web pages:

- [Rock types](#)
- [Rocks: igneous, metamorphic and sedimentary.](#)
- [The Geologic Story of Colorado's Sangre de Cristo Range](#)



Discussion: Post a response to this question in your discussion group, then respond to one of your classmates' posts.

"The deeper we dig, the farther back in time we see..."



This is a pretty well-accepted theory, but is it actually meaningful?

Consider the world's oldest rock. Of course, it was subject to heat and pressure over a very long time, but according to Professor Nelson of Tulane University, that very old rock might not have changed much in the last billion years.

Are there limits to the value of discussing very long time frames, when it comes to rocks, or do you think that since rocks are constantly changing (based on their conditions) that we need to consider their entire life cycles?

2. Rock Deformations and Oil Traps

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Sedimentary Rock Deformations and Basic Oil Traps

In this module we will explore the several types of rock deformations and ask how they contribute to "oil traps."

Objective and Big Questions

At the completion of this module you will be able to:

- Differentiate between the types of rock deformations.
- Explain which have the best chance for petroleum to accumulate.

As you work through this module, keep the following questions in mind:

- How could very hard rocks get folded or warped?
- Does it still happen today?
- Which kinds of deformations best lend themselves to oil and gas traps?



Reading:

Read the chapter on "Folds, Faults, and Traps" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Lectures:

[Lecture 1: Folds and Faults](#)



Notes for Lecture 1

Lecture 2: Basic Oil Traps 1



Notes for Lecture 2

Lecture 3: Basic Oil Traps 2



Notes for Lecture 3

Lecture 4: Basic Oil Traps 3



Notes for Lecture 4



Links:

Please visit and study the following video:

- [Folding, faulting, and geological maps](#)

3. Source Rocks, Generation, Migration, Accumulation of Petroleum
This course provides an overview of the petroleum technology industry.
This course is aligned with the textbook: "Fundamentals of Petroleum" by
Kate VanDyke. Course author: Lee McMains, lee.mcmains@aims.edu

Source Rocks, Generation, Migration, Accumulation of Petroleum

In this module we will explore which rock types make good source rocks. We will follow oil and gas as it is created, then as it flows upward and is trapped.

Objective and Big Questions

At the completion of this module you will be able to:

- Recognize which rock types tend to release petroleum.
- Explain how petroleum flows upward and becomes trapped.

As you work through this module please keep the following questions in mind:

- Are there really underground lakes of oil?
- Where do oil and gas come from?
- Which kinds of deformations best lend themselves to oil and gas traps?



Reading:

For this module, please begin by reading "Accumulations of Petroleum" and "Reservoir Fluids and Pressure" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Links:

Please watch and study the following videos:

- [Crude](#)
- [Migrating and Trapping of Natural Gas and Crude Oil](#)



Self-check:

Exercise:

Problem:

Name the two main theories about how hydrocarbon deposits formed on Earth.

Solution:

- Biogenic Theory
- Abiogenic Theory

Exercise:

Problem:

A rock that has a lot of holes, allowing for liquids to be trapped, has a high amount of _____.

Solution:

porosity

Exercise:

Problem:

A rock that has a lot of connected holes, allowing for liquids to travel throughout, has a high amount of _____.

Solution:

permeability

4. Fundamental Mapping Methods

This course provides an overview of the petroleum technology industry. This course is aligned with the textbook: "Fundamentals of Petroleum" by Kate VanDyke. Course author: Lee McMains, lee.mcmains@aims.edu

Fundamental Mapping Methods

In this module we will discuss different ways to explore for - and possibly identify the profitability of - petroleum accumulations.

Objective and Big Questions

At the completion of this module you will be able to:

- Explore fundamental mapping methods.

As you work through this module please keep the following questions in mind:

- What sort of information is available from mapping data?
- How is this data gathered?



Reading:

For this module, please begin by reading "Survey Tools and Databases for Collecting Data", "Seismic Surveys and Interpretation", and "Types of Well Logs and Core Samples" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Links:

Please watch and study the following video:

- [3D Seismic](#)

5. GIS and GPS

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GIS and GPS

In this module we will discuss different tools used to identify, record, and manage locations where petroleum accumulations are likely to be found.

Objective and Big Questions

At the completion of this module you will be able to:

- Identify mapping layers using geographic information systems.
- Perform simple global positioning maneuvers using a handheld GPS device.

As you work through this module please keep the following questions in mind:

- What is the difference between GIS and GPS?
- Which is the more "fundamental" technology?
- Who gathers the data, and what happens to it?
- How is the data manipulated to produce something meaningful?



Reading:

For this module, please begin by reading "Contour Maps and Digital Computer Models" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Links:

Please visit the following web page to get a feel for a particular GIS package: [What is GIS?](#)

Please watch and study the following videos:

- [3D The Truth About GPS: How it Works](#)
- [Farming by GPS Saves Money, Environment](#)
- [GPS Rover - Survey](#)
- [Technology: a GIS Journey](#)
- [Geospatial BI for Oil and Gas](#)



Self-check:

Exercise:

Problem:

How many satellites are required for GPS to find a location on the Earth's surface?

Solution:

3

6. Mineral Rights and Leasing

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Mineral Rights and Leasing

In this module we will examine the history - and development of - leasing mineral rights for oil and gas exploration and production.

Objective and Big Questions

At the completion of this module you will be able to:

- Explain the diverse policies related to drilling and production internationally.
- Understand the history of mineral rights in the United States.

As you work through this module please keep the following questions in mind:

- Why don't companies drill all over the U.S.?
- Why don't companies drill all over the world?
- Why is environmental law so confusing?



Reading:

For this module, please begin by reading "Mineral Rights and Leasing" in your textbook. Be sure to read the tables, look at the figures, and study the examples.

7. Drilling for Oil and Gas

This course provides an overview of the petroleum technology industry. This course is aligned with the textbook: "Fundamentals of Petroleum" by Kate VanDyke. Course author: Lee McMains, lee.mcmains@aims.edu

Drilling for Oil and Gas

In this module we will examine many of the aspects of drilling for oil and natural gas, including drilling rig types, directional drilling, and artificial lift methods.

Objective and Big Questions

At the completion of this module you will be able to:

- Explain the history of oil production in the United States.
- Describe the innovations that led to increased safety and efficiency in the drilling phase of the industry.
- Effectively differentiate between the primary rig types, as well as the systems they have in common.
- Explain the differences between different drilling methodologies and environments.

As you work through this module please keep the following questions in mind:

- What are the proper (e.g. safe, effective) working environments for the different drilling rig types?
- How have drilling safety procedures changed in the last 150 years?
- What is it like to work on an active rig?



Reading:

For this module, please begin by reading about "Drilling Systems", "Offshore Drilling", and "Blowout Preventers" in your textbook. Be sure to read the tables, look at the figures, and study the examples.



Assignment:

Research and write a paper on the Blowout Preventer. Here are some questions to consider for this assignment:

- What purpose does it serve?
- How does it function? (You can include graphics.)
- Where in the drilling assembly is it installed?
- At what phase of drilling is it installed?
- Is a Blowout Preventer for off-shore drilling different than one for on-shore drilling?
- Who designed the first Blowout Preventer?
- When and where was the first Blowout Preventer put into use?
- What incidents drove the need for this piece of equipment?
- Pick a modern variant (e.g. annular, ram) and describe it in detail.